Department of Toxic Substances Control

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June 28, 2000

Dear Interested Parties:

INTERIM GUIDANCE FOR SAMPLING AGRICULTURAL SOILS

The Department of Toxic Substances Control (DTSC) is responsible for evaluating environmental assessments for proposed schoolsites that will receive state funding for acquisition and/or new construction. DTSC's role is to ensure that selected properties do not contain hazardous materials at levels that may pose a threat to students and faculty. Since many of these new schools are being proposed on land historically used for agriculture, DTSC has developed specific guidance to streamline the design of Preliminary Endangerment Assessment (PEA) investigations for these properties.

Attached is the *Interim Guidance for Sampling Agricultural Soils* (Guidance) prepared by DTSC. This guidance has been developed as a supplement to the DTSC PEA Guidance Manual, and is intended to assist environmental assessors who prepare PEAs on behalf of school districts.

The Guidance provides a consistent easy to follow approach for sampling properties where pesticides have been uniformly applied. It is designed to augment, but not replace, the PEA guidance document. The Guidance contains the format and procedure for determining if a proposed schoolsite has pesticide or other chemical residues that could pose a health threat to future students and staff.

This Guidance does not apply to areas on properties where pesticides were mixed, stored, or disposed, or where hazardous materials were handled. If these areas are suspected to be present, DTSC should be contacted to determine appropriate sampling strategies.

Prior to initiating the PEA activities, it is recommended that school districts and their consultants participate in a project scoping meeting with DTSC. The purpose of the scoping meeting is to evaluate the Guidance's applicability for use at the proposed schoolsite, and agree upon a management approach for collecting information. For additional information regarding the enclosed Guidance please contact Mr. Javier Hinojosa, Senior Hazardous Substances Scientist, at (818) 551-2172.

Interim Guidance for Sampling Agricultural Soils

California Department of Toxic Substances Control

June 2000

Preface

Effective January 1, 2000, new California Department of Education statutes require the Department of Toxic Substances Control (DTSC) of the California Environmental Protection Agency (CalEPA) to review environmental assessments for proposed new school sites and/or new construction school expansion projects. Many of these sites are situated on land previously used for agriculture where residual agricultural chemicals may remain in the soil. Recent investigations of some agricultural sites have revealed the presence of elevated pesticides that may pose a threat to human health and the environment. This sampling guidance is intended to provide a uniform approach for evaluating former agricultural properties where pesticides have been applied.

This guidance is intended to supplement the DTSC Preliminary Endangerment Assessment (PEA) Guidance Manual (Manual), CalEPA 1994 (Second Printing, June 1999). Data obtained from the investigations should be evaluated for potential health risks according the PEA Manual. In no way is this meant to diminish the need to take focused, authoritative samples at site locations commonly associated with hazardous substances releases nor replace guidance provided by the PEA Guidance Manual. This guidance in not applicable to areas where pesticides were mixed, stored, disposed, or areas where pesticides may have accumulated, such as ponds and drainage ditches.

The scope of this document is limited to evaluating only agricultural lands during a PEA or other initial sampling investigation related to proposed new and/or expanded school sites. These are properties (or portions of properties) where pesticides were uniformly applied for agricultural purposes consistent with normal application practices, and where other non-agriculturally related activities have been absent. The data obtained from the sampling analyses will be incorporated into the PEA Report, including performing a risk analysis in accordance with the guidance in the PEA Manual.

This guidance does not apply to disturbed land, such as, land that has been graded in preparation for construction, areas where imported soil has been brought in, or any other activity that would redistribute or impact the soil, other than normal disking and plowing.

This guidance is an initial effort to streamline the characterization of former agricultural sites. As additional knowledge and experience is obtained, DTSC may modify this guidance, as appropriate.

Interim Guidance for Sampling Agricultural Soils

California Department of Toxic Substance Control

Purpose

This guidance was prepared for use in evaluating soil at proposed new school sites and/or new school construction expansion projects that were previously used for agriculture because residual agricultural chemicals may remain in the soil that may pose a threat to human health and the environment. This sampling guidance is intended to provide a uniform and streamlined approach for evaluating agricultural soils. It is intended to assist environmental assessors in designing initial investigations or developing Preliminary Endangerment Assessment (PEA) Work Plans for sites with historical agricultural uses.

The scope of this document is limited to evaluating agricultural land during a PEA or other initial sampling investigation related to proposed new and /or expanded school sites. It is limited to the sampling of agricultural lands where pesticides were presumably applied, more or less uniformly, for agricultural purposes consistent with normal application practices, and where no other non-agricultural related activities occurred. The analytical data obtained will be incorporated into the PEA Report and a risk analysis must be performed in accordance with the guidance in the PEA Manual.

Sampling Frequency and Location

Sampling frequency may vary depending on the size of the site and conditions found. If the site has been uniformly used for a single agricultural purpose, the presumption is that agricultural chemicals were applied equally to the site in any given year and the distribution will be relatively uniform. When differing agricultural activities took place on different areas, each area should be addressed separately and the sampling rate should be sufficient to characterize each area.

The sampling pattern should be a triangular grid with the starting point randomly selected or other systematic random sampling array. Each location should be sampled to include one surface sample (0 to 6 inches or 0 to 1 foot, inclusive) and one subsurface sample (2 to 3 foot range). [Note: 0 inches means first encountered soil. Thick mats of vegetable material, roots, and other extraneous material need not be sampled.] For better coverage the surface sample may be a composite of subsamples not to exceed 5 subsamples for organochlorine pesticide analysis and consistent with laboratory detection limit capabilities. The subsamples should be individually mixed and uniformly split by the laboratory or trained field staff prior to compositing. Mixing and compositing should be performed under uniform, controlled conditions. The unused portion of each subsample should be retained and frozen in case analysis is warranted from the composite results. The samples may be discarded once DTSC has completed its review of the PEA Report.

In fields where rows remain, roughly half of the samples should be gathered from the furrows and half from the beds in an alternating pattern. Orchards should have some of the locations placed at the current drip line for the trees if boom sprayers were employed to apply the pesticides.

Land Size	Suggested Minimum Sampling Frequency
One (1) acre	Four (4) discrete samples
Two (2) acres	Eight (8) discrete samples
Greater than two (2) up to twenty (20) acres; Grammar Schools	Eight (8) composite samples from discrete samples taken on half-acre centers.
Twenty-one (21) to sixty (60) acres; Middle and High Schools	Fifteen (15) composite samples from discrete samples taken on one (1) acre centers.
Greater than sixty (60) to one hundred (100) acres	Twenty (20) to thirty (30) composite samples from discrete samples taken on one (1) acre centers.
Greater than one hundred (100) acres	Consult with DTSC

Fence lines, ditches, canals, berms, and other areas, that may have been treated differently than the field, are not considered in this guidance. These areas may require biased, discrete sampling and should not be included in the composites or the sampling numbers for the areas of uniformly applied pesticides.

Compositing should only be done when the detection limit for the method does not exceed the recommended minimum detection limit listed in Table 1 of an analyte divided by the number of subsamples in the composite. When the result of a composite sample exceeds the detection limit in table 1 divided by the number of subsamples for an analyte, the subsamples must be analyzed individually for the analyte. For each analytical screening method there will usually only be two or three target analytes that limit the ability to composite. The detection limit for the majority of the target analytes will be sufficient.

When compositing is employed, all of the discrete samples of those composites exhibiting the highest concentration of analytes must also be analyzed. Subsamples should be archived.

Initial analysis need only be performed on the surface samples. If all of the surface sample results reveal only one or two analytes at concentrations well below their residential soil Preliminary Remediation Goal (PRG) values or nondetect, then only 10% (but not less than 2) of the subsurface samples corresponding to the highest surface sample locations need to be analyzed. [Examples: (1) When using composites, each discrete sample associated with the composite sample having the highest concentration must be analyzed along with the associated subsurface discretes. (2) When only discrete samples have been taken, the subsurface discretes associated with the two highest surface

samples must be analyzed plus any additional subsurface samples needed to achieve 10% of the total. All samples should be archived in a frozen state until the Department has reviewed the data. DTSC may require additional sampling and/or analysis depending on the initial results.

Rationale: When information about a site indicates that the land was used for agriculture, it is assumed that the land was farmed in a uniform manner. Each field of the same crop is assumed to have been watered, fertilized and treated with agricultural chemicals to the same degree across the field. Contaminant levels are expected to be similar at any given location within the field. For 2 acres or larger, a minimum of 8 analyses is intended to provide for the best statistical confidence using the least number of samples. A higher frequency of sampling (1/2 acre centers) is chosen for grammar school aged children who may be at greater risk from any soil contamination. The highest concentrations are expected at the surface. This is because the root zone (surface to 3 feet) contains the highest levels of carbon that will tend to retain organic chemicals to a greater extent than subsurface soils. Sampling both the furrows and beds of existing rows will detect the greatest variability in the residuals. Some methods of pesticide application will favor residuals in the beds while others favor the furrows. Standard holding times need not be observed for frozen samples that will be analyzed for pesticides. The contaminants of concern are persistent, nonvolatile chemicals. Freezing the samples stops biological activity and maintains the analytes in a solid state. No deterioration is expected during the time period required to complete the PEA. Holding times for other types of analyses must be observed.

Analytical Methods

When the land is under active agricultural practices, the grower must be interviewed to determine the types and amounts of pesticides historically used. The County Agricultural Commissioner must be consulted to verify pesticide usage on the property. The local or specialized farm advisor can provide information on farming practices in the area. These consultations should occur during the Phase 1 investigation. The Agricultural Commissioner is required to maintain this information three years, but often will have extensive knowledge of the farming practices over many years. Analysis should be performed for the most persistent pesticides used. In addition, analysis for organochlorine pesticides and heavy metals should always be performed.

Table 1 lists methods for some of the pesticides. For those pesticides where a method is not indicated, the laboratory must either use a recognized method for a soil matrix or have validation data to support the method used. Table 2 lists half-lives of selected pesticides which may be used to help focus the analyses chosen to the pesticides expected to remain at the site based on persistence, application rates, irrigation practices, and on toxicity, etc. Rationale should always be provided for not analyzing for pesticides known to have been used at the site.

For those sites that are not actively farmed the following are suggestions for choosing appropriate analyses:

- If good supporting information exists (i.e., Agricultural Commissioner records, grower interviews, aerial photographs, etc.) that no agricultural chemicals have been applied for the last 3 years, then analysis may be limited to organochlorine pesticides, paraquat and heavy metals. DTSC may eliminate paraquat analysis if it is determined that paraquat was not used or the frequency and rates of application were minimal.

Additional analytical requirements:

- Four discrete samples should be analyzed for the CAM 17[1] heavy metals.

- Analysis for arsenic must be performed on discrete samples only. The number of discretes need not exceed the number of total composite samples used for other analytes.

- Analyses for lead must be performed on all composite samples.

- Off-site samples should be collected at four locations, both surface and subsurface, to determine background or ambient levels of metals. Initially, surface samples should be analyzed for arsenic and lead. Additional analysis may be required depending upon results of all the samples analyzed.

Rationale: The above approach is meant to detect the longest lived, most toxic, or most used pesticides & herbicides. Even though many of the organochlorine pesticides are banned, residuals are still being found and will continue to exist in the soil for years[2], it is important to document that the levels are no longer significant. Other analytes should be selected based on a reasonable assessment of what was actually used. Most agricultural soil is considered to be in an aerobic state (exceptions include rice fields); agricultural chemicals that are relatively stable under aerobic conditions are the targets for sampling. When near surface conditions exist that establish anaerobic soil over an extended time, anaerobically stable pesticides should be considered as targets when their use is suspected [i.e., ametryn, cyromazine, thiabendazole]. Heavy metals are selected not only because of agricultural usage, but to detect natural mineral deposits that may pose an unacceptable risk. Additional scans should be employed where knowledge of the site indicates other contaminants may be present. Off-site samples are principally taken to evaluate the metal concentrations found on-site.

[1]antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc.

[2] California Department of Food and Agriculture, *Agricultural Sources of DDT Residues in California's Environment*, Sept. 1985.

Quality Control

Quality control procedures specified in SW-846 must be followed. A matrix spike/matrix spike duplicate on one soil sample per batch of samples must be performed to demonstrate that the targeted pesticide(s) can be recovered from the soil investigated. Highly organic topsoil may interfere with proper extraction of pesticides.

Rationale: The data must be definitive in order to evaluate risk and analytical difficulties properly evaluated.

Reporting

The report should provide the rationale for selecting the locations, depths, and analytical methods.

The laboratory data package must include a summary of the quality control sample results: blanks, matrix spike/matrix spike duplicate, surrogate recoveries, laboratory control samples, etc., as specified by the method. The laboratory should provide a signed narrative stating whether the QC was met and listing any discrepancies. The data must be qualified in accordance with the National Functional Guidelines (EPA-540R-94-012 and -013) or most recent EPA guidance in effect at the time the work plan is approved.

Rationale: The Department's staff needs to understand the logic the consultants used in selecting the samples. As increased knowledge is available about a site, the sampling effort can be more focused and efficient in providing the necessary information that the site has been properly assessed. The quality of the data must be documented to give assurance that the data is valid and appropriate to its use. This will avoid having to repeat the sampling and analysis, and will allow for review of the decisions made. The National Functional Guidelines is used by EPA to evaluate data and is a well-recognized protocol. Data may be qualified using alternative procedures as long as the protocol is described or referenced.

Data Interpretation

Detectable amounts of all agricultural chemicals should be evaluated for risk in accordance with the PEA Manual. The highest composite and discrete sample concentrations should be used for the exposure point concentrations for the risk evaluation. In cases where these two concentrations are relatively equivalent, only the highest concentration should be evaluated. Additional analyses may be required by DTSC depending upon review of the site characterization data**.** Metal results should be compared to background levels (use local background levels as a first comparison) in order to determine if they should be included as potential chemicals of concern in the risk evaluation. Because agricultural activities cover large areas of ground, background sampling locations must be carefully selected and evaluated.

Problem Areas

Failure to sample the top six inches of soil can result in a low bias in the results. Most long-lived pesticides are solids that bind strongly to organic matter and soil. Many

pesticides will only be found in the top few inches of soil until mixed deeper by plowing. The top six inches contain the greatest concentration of humic acids (complex, naturally occurring organic compounds), which may interfere with the recoveries of the matrix spikes. A 0 to 1 foot sample may result in some dilution but should be acceptable for assessing risk, since over time some soil mixing and movement are expected to occur, especially during construction.

Any extraordinary grading not related to agricultural cultivation can greatly alter the distribution of contaminants. Leveling, excavation, and soil importation can result in surface contaminants being concentrated into mounds or buried at shallow depths, and potentially introduce unsuspected contaminants. A site visit prior to or during sampling should be considered to visually assess effects of recent activities and modify the sampling protocols as appropriate.

Table 1 includes a list of pesticides with recommended minimum detection limits which should provide adequate data for the risk evaluations. If Table 1 does not have a recommended minimum detection limit for a pesticide of concern, a DTSC toxicologist must be consulted to identify an appropriate minimum detection limit.

Detection limits achieved during analysis must be carefully noted. For instance, the actual detection limits for aldrin, dieldrin, and toxaphene may exceed the recommended detection limits. If DDT is detected above the range of the calibration, the laboratory will dilute and reanalyze the samples reporting only the final result. As a result, the reported detection limits for aldrin, dieldrin, and toxaphene may exceed the recommended detection limits needed for determining potential health risks. Ideally the laboratory should be asked to report if those three analytes were detected in the first analysis prior to dilution. Multiple analyses of the same samples may be required to obtain the necessary data.

Table 1: Preferred Analytical Methods for Selected Pesticides

Pesticide	Methods	CAS No.[2]	RMD[1] mg/kg
ALDRIN	8081A, 8270C	309-00-2	0.10[a]
AMETRYN	507*, 609*	834-12-8	550[b]
ATRAZINE	8141A by NPD	1912-24-9	2.2[b]
BENSULIDE[1]		741-58-2	1200[b]
BROMACIL	8321A	314-40-9	
CHLORDANE	8081A	57-74-9	0.10[a]
CHLORONEB[1]	8081A(R)	2675-77-6	690[b]
CHLORSULFURON		64902-72-3	3100[b]
CRYOLITE[1]		15096-52-3	76000[b]
CYROMAZINE		66215-27-8	460[b]
DBCP	8081A	96-12-8	0.06[b]
DDD	8081A	72-54-8	0.10[a]
DDE	8081A	72-55-9	0.10[a]
DDT	8081A	50-29-3	0.10[a]
DIELDRIN	8081A	60-57-1	0.10[a]
DIENOCHLOR[1]		2227-17-0	0.03[b]
DIMETHIPIN		55290-64-7	1200[b]
DIMETHYLARSINIC_ACID[1]		75-60-5	180[b]
DINITRAMINE[1]	8091	29091-05-2	1500[b]
DIQUAT DIBROMIDE		85-00-7	130[b]
DSMA[1]		144-21-8	1.0[b]
ETHOFUMESATE		26225-79-6	
ETHYLENE_DIBROMIDE	8011, 8021B, 8260B	106-93-4	0.0049[b]
FENARIMOL	507*	60168-88-9	
FENBUTATIN_OXIDE[1]		13356-08-6	16[b]
FENPROPATHRIN[1]		39515-41-8	2700[b]
FENURON[1]	8321A	101-42-8	110[b]
FENVALERATE[1]		51630-58-1	2700[b]
FLUMETRALIN		62924-70-3	
FLUOMETURON[1]	8321A	2164-17-2	790[b]
FOMESAFEN		72178-02-0	2.6[b]
HEPTACHLOR	8081A, 8270C	76-44-8	0.10[a]

Pesticide	Methods	CAS No.[2]	RMD[1] mg/kg
HEXACHLOROBENZENE	8081A, 8121, 8270C, 8275, 8410	118-74-1	0.30[b]
IMAZALIL		73790-28-0	790[b]
IMAZAPYR_ACID[1]		101917-66-2	15000[b]
IMAZAPYR_ISOPROPYLAMINE_SALT[1]		81335-77-5	15000[b]
IMAZAQUIN-ACID[1]		81335-37-7	15000[b]
IMAZETHAPYR		101917-66-2	15000[b]
ISOFENPHOS[1]		25311-71-1	14[b]
ISOPROPALIN	8091	33820-53-0	920[b]
ISOXABEN		82558-50-7	3100[b]
LINDANE	8081A	58-89-9	0.10[b]
MEPIQUAT_CHLORIDE	549.1*	24307-26-4	1800[b]
METHOXYCHLOR	8081A	72-43-5	0.40[a]
METOLACHLOR	507*	51218-45-2	9200[b]
METRIBUZIN	507*	21087-64-9	1500[b]
MIREX	8081A(R), 8270C	2385-85-5	0.10[a]
MONURON[1]	8321A, 8325	150-68-5	110[b]
MSMA[1]		2163-80-6	1[b]
NEBURON[1]	8321A	555-37-3	110[b]
NORFLURAZON	507*	27314-13-2	2400[b]
ORYZALIN		19044-88-3	3100[b]
OXADIAZON		19666-30-9	310[b]
PACLOBUTRAZOL		76738-62-0	790[b]
PARAQUAT_DICHLORIDE	Zeneca SOP RAM 272/01; 549.1*	4685-14-7	270[b]
PENDIMETHALIN	8091	40487-42-1	2400[b]
MSMA[1]			
PENTACHLOROPHENOL	8041, 8151A, 8270C, 8410	87-86-5	3[b]
PICLORAM	8151A(R)	1918-02-1	4300[b]
PIRIMICARB		23103-98-2	
PROCHLORAZ		67747-09-5	3.2[b]
MSMA[1]			
PROCYMIDONE		32809-16-8	

Pesticide	Methods	CAS No.[2]	RMD[1] mg/kg
PRODIAMINE		29091-21-2	
PROFLURALIN	8091	26399-36-0	370[b]
PROMETON	507*	1610-18-0	920[b]
PROMETRYN	507*	7287-19-6	240[b]
PROPAZINE	507*	139-40-2	1200[b]
PROPICONAZOLE		60207-90-1	790[b]
SIDURON	8321A, 8325	1982-49-6	
SODIUM_CHLORATE		7775-09-9	
SULFOMETURON-METHYL		74222-97-2	
TCA-SODIUM		76-03-9	
TEBUTHIURON	8321A, 507*	34014-18-1	
TERBACIL	507*	5902-51-2	790[b]
TERBUTRYN	507*	886-50-0	61[b]
THIABENDAZOLE		148-79-8	
TOXAPHENE	8081A, 8270C	8001-35-2	2.5[a]
TRIADIMENOL		55219-65-3	
TRICHLORONAT	8141A	327-98-0	
TRIFLURALIN	8091, 8081A(R), 8270C	1582-09-8	63[b]

*Water and Wastewater Methods. Soil must be extracted and the method validated by the laboratory for a soil matrix.
(R) = must be requested for inclusion in the method
(1) Recommended minimum detection limits based on either meeting minimum quantitation limits ([a]) provided by DTSC Hazardous Materials Laboratory or requirements for risk evaluation ([b]).
(2) CAS = Chemical Abstract Service registry number

Table 2: Relative Half-lives of Selected Pesticides

Pesticide	Field Dissipation half-life (days)			Degradation half-life (days)	
	low	high	weighted	aerobic	anaerobic
ALDRIN	10	1237	365		
AMETRYN	11	216		37	stable
ATRAZINE	18	402		330	77
BENSULIDE	3	180			
BROMACIL	61	349	207	275	
CHLORDANE	283	3500			
CHLORONEB	90	180	130		
CHLORSULFURON	18	185		88	
CRYOLITE			3000		
CYROMAZINE	75	284	189	142	stable
DBCP	180	225	203		
DDD	712	5554			
DDE	712	5554			
DDT	712	5340			
DIELDRIN	225	1260			
DIENOCHLOR	300	300			
DIMETHIPIN	168	192		413	
DIMETHYLARSINIC_ACID	20	225			
DINITRAMINE	8	150			
DIQUAT DIBROMIDE				>1000	
DSMA	180	180		180	
ETHOFUMESATE	20	150	80	143	759
ETHYLENE_DIBROMIDE	28	180	100		
FENARIMOL	165	360	274	840	
FENBUTATIN_OXIDE	90	100	95	365	
FENPROPATHRIN	1	144			
FENURON	7	135			
FENVALERATE	22	240	57	163	
FLUMETRALIN	170	212	191	2000	14
FLUOMETURON	60	171		189	378
FOMESAFEN	100	360	185		

Pesticide	Field Dissipation half-life (days)			Degradation half-life (days)	
	low	high	weighted	aerobic	anaerobic
HEPTACHLOR	40	2000			
HEXACHLOROBENZENE	14	2080			
IMAZALIL	30	189	150		
IMAZAPYR_ACID	90	712			
IMAZAPYR_ISOPROPYLAMINE_SALT	90	712		4.5	
IMAZAQUIN-ACID	7	120			
IMAZETHAPYR	60	130			
ISOFENPHOS	12	365	103	93	
ISOPROPALIN	23	301			
ISOXABEN	30	180	100		
LINDANE	38	1424	423		
MEPIQUAT_CHLORIDE	1000	1000			
METHOXYCHLOR	7	210			
METOLACHLOR	97	292	141	26	37
METRIBUZIN	23	128	47	172	439
MIREX	1825	4380			
MONURON	75	345			
MSMA	10	2372			
NEBURON	38	270	130		
NORFLURAZON	163	163		130	240
ORYZALIN	20	128			
OXADIAZON	30	180	75	180	180
PACLOBUTRAZOL	7	973			
PARAQUAT_DICHLORIDE	99	4747	1067		
PENDIMETHALIN	8	480	174	1300	60
PENTACHLOROPHENOL	10	178		10	178
PICLORAM	31	206	108	300	
PIRIMICARB	7	234			
PROCHLORAZ	6.5	120		130	
PROCYMIDONE	7	120			
PRODIAMINE	69	120			
PROFLURALIN	9	160	110		
PROMETON	309	3084	1300	932	557

Pesticide	Field Dissipation half-life (days)			Degradation half-life (days)	
	low	high	weighted	aerobic	anaerobic
PROMETRYN	6	360	76	286	
PROPAZINE	35	347	123		
PROPICONAZOLE	109	123	115	53	84
SIDURON	120	150	128		
SODIUM_CHLORATE	45	456	200		
SULFOMETURON-METHYL	7	120		28	
TCA-SODIUM	4	100			
TEBUTHIURON	13	450		1050	
TERBACIL	50	252		520	
TERBUTRYN	17	358	127	38	140
THIABENDAZOLE	833	1440	1100	640	stable
TOXAPHENE	9	500			
TRIADIMENOL	90	510	300		
TRICHLORONAT	139	139			
TRIFLURALIN	15	149	81	169	
Source: ARS Pesticide Properties Database http://www.arsusda.gov/rsml/ppdb1.html (d) = days					

Sources of Information

Pesticide physical properties and half-lives:	http://www.arsusda.gov/rsml/ppdb1.html http://ace.orst.edu/info/nptn/ppdmove.htm
Active pesticide ingredient by brand name:	http://www.cdpr.ca.gov/ - see databases *Farm Chemicals Handbook*, current edition, Meister Publishing Company, Willoughby, Ohio.
Maximum application rates:	*Agricultural Chemicals – Thomas Publications, Fresno, CA*
Pesticide usage by year, county, and crop:	http://www.ipm.ucdavis.edu/PUSE/puse1.html http://www.cdpr.ca.gov/ - see databases
Statewide Background Metals:	*Background Concentrations of Trace and Major Elements in California Soils* published by Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996.
Salinas Valley Background Metals:	*Distribution of Heavy Elements Hazardous to Health, Salinas Valley Region, California*, Special Report 138, California Division of Mines and Geology, 1980.

GLOSSARY

Agricultural chemicals:	Chemicals used in the production of agricultural crops including pesticides(insecticides, herbicides, fungicides, etc.) and fertilizers.
Agricultural lands:	General term describing land used to produce agricultual products, including but not limited to food crops, dairies, cattle, poultry, sod farms, spices, fodder, tree plantations, cotton, flowers, seed farms, ranches, etc., where agricultural chemicals may have been used.
Composite samples:	Samples created by thoroughly mixing equal subparts taken from thoroughly mixed discrete samples.
Disking:	Shallow tilling of the soil usually to a depth of 4 to 8 inches.
Field:	An area of open ground suitable for cultivating crops or used as pasture.
Half-lives:	The amount of time required for a pesticide concentration to be reduced by 50% under expected field conditions (field dissipation half-life) or in a laboratory study (degradation half-life).
Orchards:	Area devoted to the cultivation of fruit trees.
Plowing:	Tilling of the soil usually to a depth near 2 feet.
SW-846	USEPA, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, Current Revision*.